Black Oak Mast Study: A Progress Report

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BLACK OAK MAST STUDY:

A PROGRESS REPORT

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Tahoe National Forest

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BLACK OAK MAST STUDY: A PROGRESS REPORT

The black oak (Quercus kelloggii) contributes several valuable assets to the forested lands of the Tahoe, but the most important factor from a wildlife standpoint is the mast produced by these trees. Acorns provide a nutritious source of winter food for many animals which may be critical for their well-being.

With the increasing commercial importance of black oak for fuelwood and sawtimber, more acres of oak are being cut than ever before. In order to avoid a significant impact to the wildlife resource of the Tahoe and other National Forests, a well thought-out oak management plan is needed. Before such a plan can be devised, however, basic data must be gathered.

It is the objective of this study to provide basic information on the mast production of the black oak. Hopefully the results of this effort will allow us to determine which oaks produce the most mast and what quantity of mast can be expected from these trees. With this information we will be able to harvest oaks with a minimum impact on the wildlife food resource.

Site Selection

Meaningful criteria for site selection could not be determined due to the lack of base data. The influence of environmental characteristics

such as slope, aspect, elevation and soils on mast production are unknown. Therefore, rather arbitrary criteria were used. They are:

1. The sites had to be accessible so that the traps can be tended with a minimum expenditure of time and money.

2. The sites had to have a sufficient number of oaks so the study plots could be kept to a modest size of from five to ten acres to avoid unnecessary conflicts with other activities.

3. Oak densities had to be low enough so mast from the study trees could be isolated from that of neighboring oaks.
4. A good representation of DBH classes was necessary so oaks with diverse individual characteristics could be sampled.

Five study plots were chosen, scattered about Nevada City in a semi-circle roughly 10 miles in radius. The name and location of these plots are:

1. Moonshine, T.18N., R.8E., S28, NE¼;
2. Clerkins Ranch, T.18N., R.9E., S16, NW¼;
3. North Bloomfield, T.17N., R.10E., S5, NW¼;
4. Mount Oro, T.16N., R.10E., S3, NW¼; and
5. Casa Loma, T.15N., R.11E., S6, N¼.

The exact locations of the plots are shown on the enclosed maps.

Tree Selection

Trees were selected primarily on the basis of DBH. Twenty trees were selected on each plot, five in each of four different size classes. These classes are:

- I 7-11" DBH,
- II 11-16" DBH,
- III 16-23" DBH, and
- IV Greater than 23" DBH.

Black oaks reportedly do not reach peak mast production until they are over 80 years old (McDonald, 1969). Size class I represents oaks too young to be in full production. The age of a tree in this class should be between 45 and 65 years (Escano and Yamanaka, 1973). The age of trees in class II should be between 65 and 90 years and they should be just achieving full production. Trees in class III are estimated to be between 90 and 130 years old, and should be at peak production. Class IV trees are estimated as being greater than 130 years in age and should be in full or decreasing production due to decadence. Whether or not these estimated relationships will hold true remains to be proven by the results of this study.

Several other criteria were also used in the selection of study trees. Only one tree per clone was sampled to avoid magnifying any influence that genetics may have on mast production. A tree was not chosen if

its crown overlapped the crowns of adjacent oaks. This prevents the intermixing of acorns from several trees which would make accurate estimates of production of the study tree impossible. With the exception of these few requirements, the closest trees satisfying the size criteria were chosen.

A take-off point (TOP) was selected in a conspicuous spot and marked with an orange paint blaze and metal plot tag. A compass bearing was taken on each consecutive tree and the distance between them was estimated by pacing. Each tree was marked with an orange paint blaze and two numbered metal tags, one at eye level and one below stump height. Trees on Moonshine are numbered from 1-20, Clerkins Ranch from 21-40, North Bloomfield from 41-60, Mount Oro from 61-80, and Casa Loma from 81-100. Direction to the TOP and a map of study tree locations in respect to the TOP are included.

Tree Measurement

Various measurements were taken on each tree. Crown diameter was estimated with a clinometer and tape. The clinometer was used to determine a perpendicular line to the edge of the crown. Two measurements of the crown diameter were taken at right angles to one another. These two measurements were averaged to give the recorded figure. The crown diameter can be used to estimate the total area of the crown. The total acorn production can be extrapolated from the quarter mil acre

sample (10.89 square feet) to the total area of the crown. Other researchers have used this method to determine total tree production (Downs and McQuiklin, 1944; Goodrum et al., 1971), but to my knowledge its accuracy has not been proven. It may be worthwhile to test this procedure. I believe it could be easily done by counting the number of acorns in one foot strips from the bole of the oak to the perimeter of the crown. If the acorns are evenly distributed over these strips, it may be safe to assume that the production of acorns in any mil acre under the crown is representative of the production for the whole area of the crown.

Height and crown ratio were estimated with trigonometric methods. A distance of 100 feet was measured out from the base of the tree with a steel tape. A clinometer was used to get degree readings to the base of the tree (θ_A), the bottom of the crown (θ_B), and the top of the tree (θ_C). Height was calculated using the formula:

$$H = 100\ (\text{Tan}\ \theta_C) - 100\ (\text{Tan}\ \theta_A).$$

Crown ratio was calculated using the formula:

$$CR = \left(\frac{100\ (\text{Tan}\ \theta_C) - 100\ (\text{Tan}\ \theta_B)}{100\ (\text{Tan}\ \theta_C) - 100\ (\text{Tan}\ \theta_A)}\right) 100$$

and is defined as the percent of the total tree height supporting green foliage. Isolated branches below the main body of the crown

were ignored if they were small, but they were added to the crown if they were of a significant size. If there were large gaps in the crown, lower branches were mentally placed in these gaps to create a full crown and the estimated angle to the bottom of this "full crown" was measured. The crown ratio is inteded to be an indicator of tree vigor, with the more vigorous trees having a higher percentage of their height supporting foliage. Shaded or diseased trees are likely to have small crown ratios.

The dominance class is a subjective estimate of the tree's position in the canopy. Five classes were used which were previously established for timber surveys. Class I contains open grown, widely spaced trees. Class II contains dominant trees with their crowns extending above the crowns of surrounding trees. Class III trees are codiminants with their crowns level with the general level of the canopy. Class IV trees are termed intermediate trees. The crown of a tree in this class is below the general level of the canopy. Class V trees are those which are overtopped by neighborning trees.

I also intended to do increment borings of the trees to determine the age and rate of radial growth, but there was not sufficient time to accomplish this. It may be worthwhile to do these measurements at some later time.

Suggested Methods for Study Continuation

I. Trap Construction: Cut 1/4" galvanized hardware cloth to the dimensions shown on the attached sheet allowing extra material for overlap. Roll into cone and wire or "hog-ring" together. It may be necessary to wire a piece of 1" chicken wire in the lower part of the cone to squirrel-proof the trap. Use tall fruit juice cans to collect acorns in (~8" tall x 5" diam.). Holes are punched at the rim of the can so it can be wired to the cone. It should be attached so it can be removed easily to collect the acorns. Holes should also be punched in the bottoms of the can to allow water to drain out. The trap is supported by two steel fence posts. Posts five feet long should be sufficient.

II. Trap Placement: Most authors recommend placing traps a distance of 2/3 of the crown radius from the bole of the sample tree. It is my belief that it is not important where the trap is placed as long as the method used is consistent from tree to tree. If strip counts are done as suggested above, a trap placement scheme can be developed on a factual basis.

III. Open plots: If it is possible, open quadrants should be placed next to the traps to measure wildlife utilization of the acorns. Quarter mil acre plots would be compatible with the size of the traps. A square plot 3.3 feet on a side

would encompass a quarter mil acre and could be defined by a stake in each corner of the plot. When the plot was to be read, a string could be stretched around the stakes and all acorns within this boundary counted.

IV. Frequency of Collection: The traps should be tended at least bi-weekly, but preferably weekly, from the beginning of the mast drop to its end. The open plots should be counted at least twice, at the end of the collection period and again in the spring to indicate how many acorns survived to the sprouting and establishment period.

V. Data Collection: The number and weight of acorns trapped should be recorded for the following categories:

1. Sound acorns,
2. Immature acorns,
3. Diseased acorns (insect or fungus), and
4. Animal damaged acorns.

The soundness of acorns has been usually tested by cutting into them, but this is a time consuming procedure. It may be possible to separate viable from nonviable acorns by floating them in water. It appears that sound acorns tend to sink, while the lighter, nonviable ones float. It would be necessary to record only the number of acorns on the open

plots.

VI. Data Analysis: The analysis of these data should determine if there is a significant difference in the mast production of the five plots (environmental influence) and identify predictive parameters of the productivity of individual trees. I believe that an analysis of variance could be done to find out if there are differences between the production of the five plots, and linear regressions could be done to relate tree characteristics with mast production. It would be worthwhile to present this problem to someone competent in statistical methods before the study is pursued any further so the data can be gathered in the best way possible for analysis.

VII. Subsequent and Final Reports: Progress reports should be written at the end of each field season. They should detail what work has been done and tabulate the data collected to that point in time. These reports should be filed with the reports of previous work so that none of the information is misplaced and lost. At the end of this project these reports will furnish a concise review of all pertinent methods and data so a meaningful and accurate final report can be prepared. It would be a disservice to all concerned if information is lost due to careless record keeping and neglect. The publication of the results of this effort should also be considered so that others may benefit from our work.

BIBLIOGRAPHY

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Escano, R., and Yamanaka, G. 1973. Baseline data on California black oak (Quercus kelloggii, Newb.) with emphasis on ponderosa pine-associated communities. U.S. Dept. Agric., Forest Service, Tahoe National Forest (79 p.), typescript.

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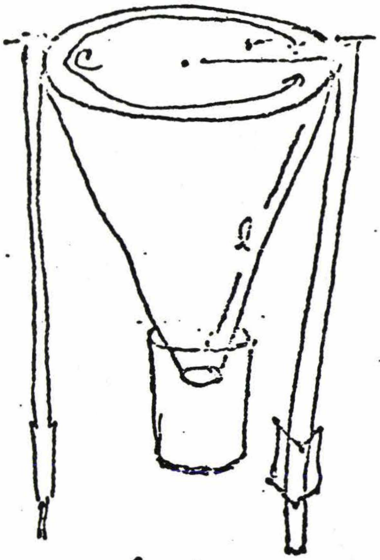
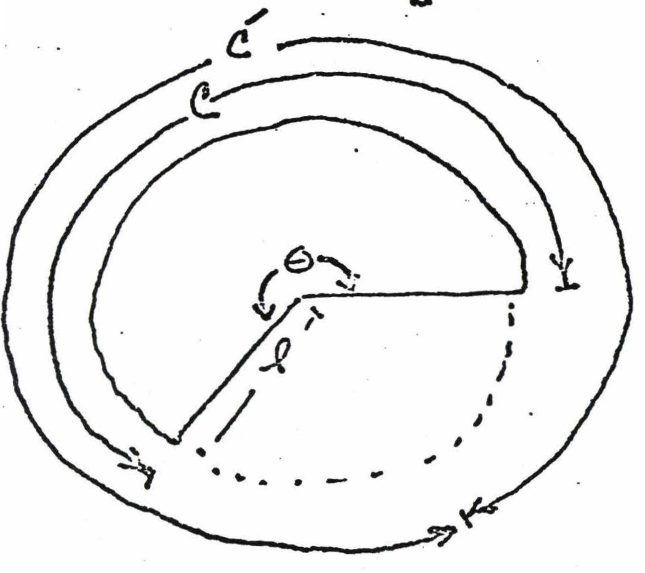
McDonald, P. M. 1969. Silvical characteristics of California black oak (Quercus kelloggii Newb.). U.S. Dept. Agric., Forest Service, Pacific Southwest Forest and Range Exp. Sta., Research Paper PSW-53, 20 p.

ACORN TRAP



1 acre = 43560 sq. ft.
mil acre = 43.56 sq. ft.
1/4 mil = 10.89 sq. ft.

$\pi r^2 = 10.89$ sq. ft
$r = 1.86'$
$2\pi r = C = 11.6808'$
$l = 3'$
$C' = 2\pi r'$
$r' = l$
$C' = 18.84'$
$\theta = \frac{11.6808}{18.84}(360) = 223.2^\circ$



Trap placement: (Downs & McQuilkin)
placed 2/3 of crown radius from trunk
30" above ground.